REMARKS

A Request for Continued Examination has been submitted concurrently with this amendment. Accordingly, Applicants respectfully request that this application be further examined, based on the amendments set forth hereinafter.

Claims 8, 9 and 22 remain pending in this application, Claims 10-14, 23, 25, 26 and 28 having been cancelled because they are directed to a non-elected invention. In addition, Claims 1-7 and 15-21 have previously been cancelled, and Claims 24 and 27 are cancelled by the foregoing amendment.

Claims 8, 9, 22, 24 and 27 have been rejected under 37 C.F.R. § 103(a) as unpatentable over Best et al (U.S. Patent No. 4,702,212) in view of Ishiwata et al (U.S. Patent No. 5,443,047). However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims which remain of record in the present application distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to an electrically activated valve of the type which is used in conjunction with fuel injection systems for internal combustion engines, for example. A feed pump feeds the fuel at a low pressure to the inlet side of a high pressure pump, which injects the fuel at high pressure into the internal combustion engine via a fuel injector. The quantity of fuel which is injected during each operating cycle is controlled by an electrically

activatable valve, such as that provided by the present invention, which intermittently establishes a connection between the high pressure line of the injection pump and a return passage. Thus, when the valve is closed, fuel is injected into the engine, when the valve is opened, fuel is passed to the return passage, such that there is no injection to the engine.

The Best et al patent, for example, discloses a system of this type. (See Figure 1.) In the embodiment illustrated in Figure 3, fuel flows from a high pressure pump into the inlet 25 and an annular chamber 22 which surrounds a valve member 33. In this embodiment, when the solenoid 36 is actuated, it pulls the tapered portion of the valve member 33 against a corresponding tapered portion of the chamber 22, preventing a flow of fuel from the annular chamber 22 to the chamber 34, where it can flow to an outlet or return flow path. When the solenoid is deenergized, on the other hand, the valve member 33 is free to move to the left, which opens a passageway between the annular chamber 22 and the annular chamber 34, so that fuel can flow to the outlet channels 32.

An important aspect of the Best et al patent is that the force for moving the valve member 33 to the left in Figure 3, in order to open the passage referred to previously, is provided by the pressure in the fuel itself, which acts on a radially extending surface 27 which creates a force that tends to move the valve member away from its seating. (See Column 2, lines 62-68.) Accordingly, in order for the Best et al valve to function properly, it is necessary that the high

pressure line enter to the left of the valve seat 24 in Figure 3, such that high pressure fluid acts on the surface 27, to provide a force counter to that of the solenoid 36.

As a further result of this structure, it can be seen from an examination of Figure 3, that the fluid flow in Best et al is from left to right in the figure, in the same direction as the force exerted by the solenoid. In contrast to this arrangement, in the invention as defined by Claim 8, the flow direction from the high pressure line to the return flow duct is in the opposite direction to the force which is exerted by the solenoid. Thus, Claim 8 recites that a valve spring exerts a force in a first direction on a valve stem and valve member and that the activating device (solenoid 3), when activated, provides a force in a second direction opposite to the first direction. In addition, Claim 8 further recites that the valve member interacts with a valve seat on the valve housing to determine a flow from the high pressure line through the valve "in a flow direction that corresponds to said first direction" (in other words, in the direction opposite the direction of the force exerted by the solenoid.

In addition, Claim 8 further recites that the switching valve also includes an annular space formed between the valve housing and the valve stem, as well as an annular contact area formed between the valve member and the valve seat, downstream of the annular space. More importantly, Claim 8 further specifies that the contact area is bounded "at a downstream edge thereof by a step

adjoined by a flow optimizing guide surface" which is configured to avoid cavitation. The latter features of the invention are neither taught nor suggested by Best et al, in which the flow direction is, and must be, in the opposite direction in order for the high pressure fluid to act on the radially disposed circumferential surface 27, urging the valve member 33 in a direction opposite the force exerted by the solenoid. If, in fact, the direction of flow were reversed, such that the step (which according to the Office Action refers to the sharp edge between the cylindrical portion and the tapered portion of the valve member 33) were disposed "at a downstream edge" of the contact area, as recited in Claim 8, the high pressure fluid would not reach the surface 27, and would be incapable of providing the necessary force to move the valve member 33 leftward in the figure.

Claim 22, on the other hand, also recites that the flow direction from the high pressure line to the return duct corresponds to the "first direction, in which a force is exerted by the spring, and opposite to that exerted by the activating device". In addition, the last two paragraphs of Claim 22 recite that the valve member has a step formed by a longitudinally extending offset in the surface of the valve member itself, which step is concentric to the valve stem and has a radius which exceeds the radius of the inner circumference of the opening of the valve housing. Furthermore, Claim 22 also recites that the step portion is adjoined by a flow optimizing guide surface, which is formed in a radially outer

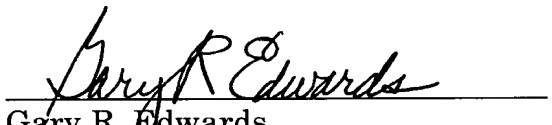
portion of the valve member itself. The latter features of the invention are also neither taught nor suggested by Best et al. That is, accepting the characterization in the Office Action that the "sharp edge" between the cylindrical and tapered portions of the valve member 33 can be considered to be the step, the latter is not adjoined by a guide surface, such as recited in the claim, which is formed in a radially outer portion of the valve member. Moreover, given the difference in flow direction, the assumption stated in the Office Action that the tapered surface of the valve member 33 performs the same cavitation avoiding function as that recited in Claim 22 is also doubtful. However, in all events, it is clear that Best et al does not contain a flow optimizing guide surface which is formed in the valve member, in the manner and configuration recited in Claim 22.

The Ishiwata et al reference, on the other hand, has been cited only as showing a valve which has been biased opened by a spring 40. Ishiwata et al in particular contains no disclosure which provides any of the missing details referred to hereinabove. Accordingly, Applicants respectfully submit that the combination of Ishiwata et al with Best et al would not replicate the present invention. Moreover, as Applicants have noted previously, because the entire purpose of the Best et al patent is to avoid the need for such a spring, there would be no motivation for such a combination in any event.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038738.48700).

Respectfully submitted,



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